



# Determination of Economic Value for Thymus Species (*Thymus serrulatus* and *Thymus schimperi*) in Tarmaber District, Northern Shewa, Ethiopia

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## General Note



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## ABSTRACT

This study was performed to determine willingness to pay for the direct and indirect use value of Thymus species in selected village of Tarmaber District, Northern Shewa, Ethiopia. Questionnaires were designed based on Contingent Valuation and hedonic pricing methods. Data were collected from 49 producers and users of Thymus species informants selected through systematic random sampling. The mean willingness to pay for the direct medicinal use value of Thymus species / household/ year is estimated to be 30 USD. Whereas the mean willingness to pay 9 USD for the indirect frost resistance is 5.04. In addition, the mean willingness to pay 12 USD for soil fertility and water conservation indirect use value of thymus /household /year is 4.87 and 5.08, respectively. The result

revealed that WTP was influenced by the variable like age, sex, educational level and total land hold. On the other hand, the study confirmed that the explanatory variable, which is knowledge on use of the resource, affects the WTP positively and the selling price of Thymus species negatively. The model summary ( $R^2$ ) showed that about 40% of the explanatory variables are explained in the model summary. The result revealed that training on the use of Thymus species is positively correlated with the community willingness to pay significantly ( $P < 0.05$ ). In conclusion, raising the awareness of local people on ecosystem services of bio resource is useful for the approximate economic value determination of plant genetic resources for access and benefit sharing negotiation.

**Keywords:** willingness to pay, Tarmaber, Economic value, Contingent valuation, Hedonic pricing

## 1. INTRODUCTION

Bio resources have significant economic value. It may be implicit or explicit value. Most of these values are often not captured in the market. As a result, the potential use of bio resources are regularly under estimated [1]. Such an underestimation is considered as one of the factors for rapid depletion of biodiversity and loss of habitats and species. The valuation of biodiversity/ecosystem goods is a fundamental step towards determining the real value of bio-resources, and operationalizing the ABS (Access and Benefit Sharing) provisions under Nagoya Protocol on ABS to capture the 'fair and equitable' provision of the ABS negotiations appropriately with full and informed participation of the local people and/or providers of the resources. Economic value is a measure of what the maximum amount an individual is willing to forego in other goods and services in order to obtain some good, service, or state of the world. Contingent valuation (CV) is a survey-based method frequently used for placing monetary values on environmental goods and services not bought and sold in the marketplace [1 2 3]. Thymus is one of the plant genetic resources, which have not a defined market price including the different ecosystem provisioning services. Therefore, this study was proposed to estimate the willingness to pay (WTP) of the Thymus plant genetic resource from custodians for the direct and indirect use value provided by Thymus species in selected villages of Tarmaber District, Northern Shewa, Ethiopia.

## 2. RESEARCH METHODOLOGY

### 2.1. Description of the study area

Termaber is one of the Districts in Amhara Region of Ethiopia. It is located at the Eastern edge of the Ethiopian highlands in the Semien Shewa Zone. It is bordered on the south by Ankober, on the south west by Basona Werana, on the west by Mojana Wadera, on the North West by Menz Mam Midir, on the north east by Kewet, and on the south east by the Afar Region. Geographically the district is located  $9^{\circ} 50' 51''$  N and  $39^{\circ} 45' 37''$  E with an average altitude of 2612masl. This woreda was originally named Mafud Mezezo Mojana, which is the name in the 1994 national census used. But the name was changed at some point over the next five years. In 1999, the woreda of Mojana Wadera was split off from Termaber, and a kebele transferred to it from Kewet. There are 19 rural and 4 urban kebeles. Thymus.ssp is abundantly found in six kebeles. Four of them are in moist highland and two in moist mid highland agro ecological zones of the study area. Kuash kebele is one of the moist highland, where Thymus species is found abundantly and used for different purposes. According to (CSA, 2013) up to 2017) population projection data, the total number of population of Tarmaber District is 98159.

### 2.2. Research design

Questionnaires were designed based on Contingent Valuation and hedonic pricing methods following Defra, 2007. Preliminary test were conducted to test the questioners' appropriateness. Based on pilot test, Thymus growing area was identified. Potential Thymus distribution was found to be confined in 6 kebele. 20 % of the total 6 Kebele was taken. Accordingly, informants were selected from one potential kebele by systematic random sampling. 49 respondents (sample size) were selected proportionally from the whole target population following (Miaoulis and Michener, 1976). Budget, time and labor were considered during using the sampling techniques.

### 2.3. Model Specification and data analysis

The willingness to Pay(WTP) is calculated using the equation;  $WTP = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \beta_{11}X_{11} + \beta_{12}X_{12} + \beta_{13}X_{13} + \beta_{14}X_{14}$  Where,  $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9, \beta_{10}, \beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}$  are coefficients of variables and  $X_1$ ; age of respondents,  $X_2$ ; sex of respondents,  $X_3$ ; education level of respondents,  $X_4$ ; family size of respondents,  $X_5$ ; income generated from sell (Dollar/household/year),  $X_6$ ; size of farm land (Hectar/household),  $X_7$ ; food self sufficiency,  $X_8$ ; number of sheep (No/household),  $X_9$ ; price of Thymus consumed (Dollars/kg/year),  $X_{10}$ ; value of thymus used for medicine (Dollars/household/year),

X<sub>11</sub>; value of thymus for water quality, X<sub>12</sub>; value of Thymus spp., for air quality, X<sub>13</sub>; value of Thymus for soil fertility, X<sub>14</sub>; value of Thymus for soil conservation. The collected data were analysed using SPSS software (version 21) and descriptive statistics (Mean, Percentage, Standard Deviation) and Inferential statistics (Regression Model) are used for statistical test.

### 3. RESULT AND DISCUSSION

#### 3.1. Household characteristics of Tarmaber District

About 90% of the informants were male and 10% female. About 49% of the respondents were either illiterate or had no formal education, 49% attend formal education and the remaining 2% of the informants were attending college. The average household size was 5.6, which were ----- from the national average ----- . The average land holding of the respondents was 1.34, which is ----- than the national average, which is ---.

#### 3.2. The Mean willingness to pay for Direct and indirect use value of thymus Species

The mean willingness to pay for the direct medicinal value of Thymus Spp., is 0.25 USD/year. The mean willingness to pay 9 USD/year for the frost resistance indirect use value or service as a result of thymus Species is 5.04. Whereas the remaining provision service (soil fertility and water conservation service) has 5.08 and 4.72 mean willingness to pay 12 USD/year (Table 1).

**Table 1 willingness to pay for direct and indirect use value Thymus Species**

Statistical measurement units		Medicinal value of thymus in USD per year/household	12 USD WTP per year/house hold for water conservation service	9USD WTP per year per house hold for frost resistance service	12USD WTP per year per house hold for soil fertility service
N	V	46	47	47	49
	M	3	2	2	0
Mean		0.25	4.72	5.04	5.08
Median		5.00	5.00	5.00	5.00
Std.Deviation		2.136	1.528	1.382	1.998

#### 3.3. Factors affecting the willingness to pay for Direct and indirect use value of Thymus Species

The mean willingness to pay (WTP) per household per year, standard deviation, confidence interval and the relationship between WTP and categorical variables were analyzed using descriptive statistics and two-way sample t-test. The mean willingness to pay bids also regressed with various explanatory variables. The bid function was arrived at using multiple regression analysis, starting from all the potential explanatory variables, removing the least significant one, re-estimating the model and so on until all remaining variables were significant at 95% level (Horton et al., 2003). The value functions was:  $WTP = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \dots + \beta_n X_n + e_i$  Where WTP= willingness to pay for Thymus.spp  $\beta_0$ =constant,  $\beta_1 - \beta_n$ =coefficients,  $X_1 - X_n$ =variables influencing WTP, and  $e_i$ = random error Variables that could potentially affect the farmer's willingness to pay for Thymus.spp were regressed with WTP bids by using multiple regressions. Most of the tested variables are not relating to higher WTP significantly (Table 2).

**Table 2. Dependent Variables influencing WTP for soil fertility services**

Model	Un standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	.081	3.092		.026	.979
Size of land in hectare	.933	.664	.226	1.406	.172
No of sheep available	-.098	.062	-.263	-1.588	.124
Total land of thymes in hectare	.982	.719	.221	1.367	.183
Training on thymus uses	2.866	1.233	.405	2.324	<b>.028</b>
Thymus price per kilogram	-.724	.241	-.465	-3.009	.006

As shown in the above table among five explanatory (Dependent) variables only the knowledge on use of the resource through training affects the WTP positively or significantly and the selling price of Thymus.spp per kilogram negatively. Increasing the

training on Thymus spp increases the community willingness to pay significantly ( $P < 0.05$ ). Peoples who have the awareness on Thymus species uses through training have the knowledge on soil fertility value, which may be explained by high WTP. As the number of training on Thymus species increases by 1%, the willingness to pay is also increased by 40.5% and as the area is rich with the resource and located on the main road, many youngsters retail in the market, which are affecting the farmers willingness to pay for soil fertility negatively by significant level of 0.006. The relationship between the selling price and WTP expressed as the selling price increases by 0.05 USD the willingness to pay will decrease by 2.325 USD. The bid function of Tarmaber Districts would be,  $WTP = 40.5(\text{No of training}) - 46.5(\text{selling price of Thymus Species})$ .

### 3.4. Model Summary

The reliability of the model as indicted in Table 3 shows a Predictors (Constant), for what amount of Birr do you sell one kg of thymus, Did you take training on Thymus uses, how many hectare of thymes land do you have, Size of land in hectare, No of sheep available per house hold. The model summery (Table 3) shows that  $R^2$  is 40% which implies that about 40% of the explanatory variables were been explained in the model. As Mitchll and carson (1979) explained that contingent valuation study showing  $R^2$  more than 0.15 using a few key variables is acceptable. Generally, the Thymus Species producing farmers in north shewa zone in Tarmberworeda has higher average willingness to pay, i.e. 12USD/household per year for soil fertility service of Thymus species. The farmers were willing to contribute more for training on the resource. This result showed that the people need training to aware about indirect or ecosystem services of Thymus species before reaches below the critical level by over harvesting for market.

**Table 3. Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.633 <sup>a</sup>	.400	.285	1.770

## 4. CONCLUSION & RECOMMENDATION

Economic valuation of bio-resources in an ecosystem, which have not defined market, is the pre access task of an ABS expert. In this regard, the present study examined the ecosystem service valuation and direct use value of Thymus Species in Tarmaber District, North Shewa, Ethiopia. The result showed that WTP of the Thymus species custodian were been affected by different factors such as age, educational background, training, farmland, price of Thymus and number of ships. Therefore, raising the awareness of local people on ecosystem services of bio resource is useful for the approximate economic value determination of plant genetic resources for access and benefit sharing negotiation.

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### Conflict of Interest

The authors declare no conflicts of interests any matter related to this paper.

### Data and materials availability

All related data have been presented in this paper.

### Peer-review

External peer-review was done through double-blind method.

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